

WHAT IS CLAIMED IS:

1. A vehicle braking apparatus comprising:  
a hydraulic braking apparatus including a first hydraulic braking device configured and arranged to apply a first hydraulic braking force on at least one first wheel subject to a  
5 first braking system;  
an electric braking apparatus including a first electric braking device configured and arranged to apply a first electric braking force on at least one second wheel subject to a second braking system that is different from the first braking system; and  
a regenerative braking apparatus including a first regenerative braking device  
10 configured and arranged to apply a first regenerative braking force on one of the first and second wheels subject to a corresponding one of the first and second braking systems.
2. The vehicle braking apparatus as recited in claim 1, wherein  
the first regenerative braking device is configured and arranged to apply the first  
15 regenerative braking force on the second wheel subject to the second braking system.
3. The vehicle braking apparatus as recited in claim 1, wherein  
the first regenerative braking device is configured and arranged to apply the first  
regenerative braking force on the first wheel subject to the first braking system.  
20
4. The vehicle braking apparatus as recited in claim 2, wherein  
the regenerative braking apparatus includes a second regenerative braking device  
that is configured and arranged to apply a second regenerative braking force on the first  
wheel subject to the first braking system.  
25
5. The vehicle braking apparatus as recited in claim 4, wherein  
the hydraulic braking apparatus including a first hydraulic braking device  
configured and arranged to apply a second hydraulic braking force on an additional first  
wheel subject to the first braking system;

the electric braking apparatus includes a second electric braking device configured and arranged to apply a second electric braking force on an additional second wheel subject to the second braking system; and

5 the regenerative braking apparatus includes a third regenerative braking device that is configured and arranged to apply a third regenerative braking force on the additional first wheel and a fourth regenerative braking device that is configured and arranged to apply a fourth regenerative braking force on the additional second wheel.

6. The vehicle braking apparatus as recited in claim 1, further comprising  
10 a regenerative power supply pathway configured and arranged to directly supply power regenerated by the regenerative braking apparatus to the electric braking apparatus.

7. The vehicle braking apparatus as recited in claim 1, wherein  
15 the electric braking apparatus includes a parking brake device that is configured and arranged to maintain a parking braking force.

8. The vehicle braking apparatus as recited in claim 1, wherein  
the regenerative braking apparatus includes a second regenerative braking device that is configured and arranged to be independently operable from the first regenerative  
20 braking device to provide a second regenerative braking force to one of the first and second wheels subject to one of the first and second braking systems.

9. The vehicle braking apparatus as recited in claim 1, wherein  
the regenerative braking apparatus is operatively coupled to one of the first and  
25 second wheels that is disengagably linked to a drive shaft side of an engine.

10. The vehicle braking apparatus as recited in claim 1, wherein  
the regenerative braking apparatus is operatively coupled to one of the first and  
second wheels that is linked to a non-driving shaft.

30

11. The vehicle braking apparatus as recited in claim 1, wherein the hydraulic braking apparatus includes a second hydraulic braking device that is configured and arranged to operatively couple an additional first wheel with the first wheels being front wheels.

5

12. The vehicle braking apparatus as recited in claim 11, wherein the electric braking apparatus includes a second electric braking device that is configured and arranged to operatively couple an additional second wheel with the second wheels being rear wheels.

10

13. The vehicle braking apparatus as recited in claim 12, wherein the first regenerative braking device is configured and arranged to apply the first regenerative braking force on both of the rear wheels.

15

14. The vehicle braking apparatus as recited in claim 13, wherein the regenerative braking apparatus includes a second regenerative braking device that is configured and arranged to apply a second regenerative braking force on both of the front wheels.

20

15. The vehicle braking apparatus as recited in claim 12, wherein the regenerative braking apparatus includes a second regenerative braking device that is configured and arranged to apply a second regenerative braking force on one of the rear wheels and the first regenerative braking device that is configured and arranged to apply the first regenerative braking force on the other of the rear wheels.

25

16. The vehicle braking apparatus as recited in claim 12, wherein the regenerative braking apparatus includes a second regenerative braking device that is configured and arranged to apply a second regenerative braking force on both of the rear wheels.

30

17. The vehicle braking apparatus as recited in claim 15, wherein  
the regenerative braking apparatus includes a third regenerative braking device that  
is configured and arranged to apply a third regenerative braking force on one of the front  
wheels and a fourth regenerative braking device that is configured and arranged to apply a  
5 fourth regenerative braking force on the other of the front wheels.

18. The vehicle braking apparatus as recited in claim 1, wherein  
the hydraulic braking apparatus includes a second hydraulic braking device that is  
configured and arranged to operatively couple an additional first wheel with the first  
10 wheels being rear wheels.

19. The vehicle braking apparatus as recited in claim 18, wherein  
the electric braking apparatus includes a second electric braking device that is  
configured and arranged to operatively couple an additional second wheel with the second  
15 wheels being front wheels.

20. The vehicle braking apparatus as recited in claim 19, wherein  
the first regenerative braking device is configured and arranged to apply the first  
regenerative braking force on both of the rear wheels.

21. The vehicle braking apparatus as recited in claim 19, wherein  
the regenerative braking apparatus includes a second regenerative braking device  
that is configured and arranged to apply a second regenerative braking force on one of the  
rear wheels and the first regenerative braking device that is configured and arranged to  
25 apply the first regenerative braking force on the other of the rear wheels.

22. A vehicle braking apparatus comprising:  
hydraulic braking means for applying a hydraulic braking force on at least one first  
wheel subject to a first braking system;  
30 electric braking means for applying an electric braking force on at least one second  
wheel subject to a second braking system that is different from the first braking system;  
and

regenerative braking means for applying a regenerative braking force on one of the first and second wheels subject to one of the first and second braking systems.

23. A method of controlling a braking apparatus comprising:
- 5 selectively applying a hydraulic braking force on at least one first wheel subject to a first braking system;
- selectively applying an electric braking force on at least one second wheel subject to a second braking system that is different from the first braking system; and
- selectively applying a regenerative braking force on one of the first and second
- 10 wheels subject to one of the first and second braking systems.